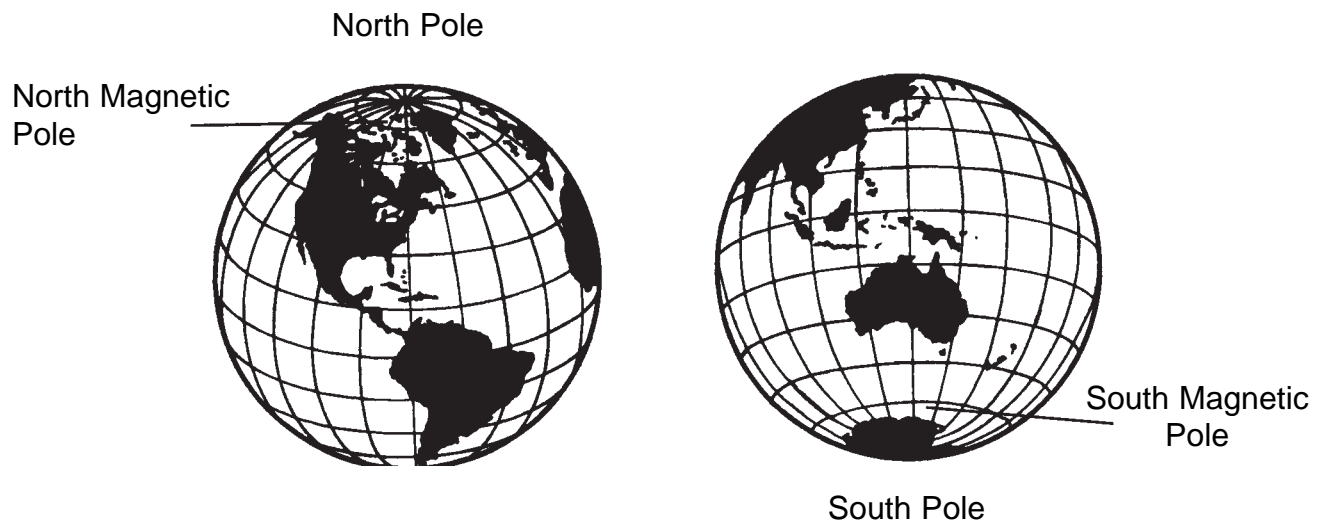


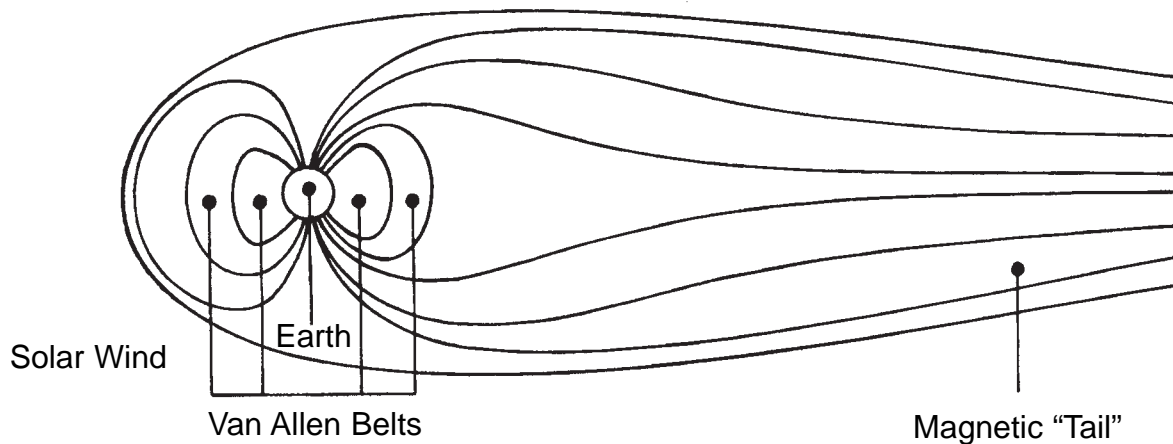
The Geomagnetic Field *(cont.)*

Earth's Poles



The geographic North and South Poles are at the ends of the axis around which Earth spins. The geomagnetic poles are inclined at an angle of about 11.5° from these North and South Poles. The North geomagnetic pole is near Ellef Ringnes Island, Canada, about 870 miles (1,392 km) from the North Pole. The South geomagnetic pole is off the coast of Wilkes Land in Antarctica and is about 1,710 miles (2,736 km) from the South Pole. The geomagnetic poles move over time.

Magnetosphere



Earth's Magnetic Tail

The magnetism around Earth is called the *magnetosphere*. Radiation from the sun (*solar wind*) blows the magnetosphere into a long tail. An area which consists of large numbers of electrons and protons from the sun is trapped by the magnetism in the *Van Allen Belts*. The aurora occurs in this area 60-620 miles (97-1,000 kilometers) above Earth.

The Aurora

Activity: learning about the aurora

Materials: pictures of the aurora, Internet access, Aurora Research Cards (pages 38 and 39), transparency of Earth's Poles and Earth's Magnetic Tail (page 37), *Guide to Space* (pages 27 and 30)

Background

The *aurora borealis* (northern lights) and *aurora australis* (southern lights) have been sources of myth since ancient times. These beautiful phenomena appear as thin veils of colored light, usually green, moving silently across the sky. Today, we know they result from disturbances in the magnetic field surrounding Earth (*geomagnetic field*). The disturbances are caused by interaction with the *solar wind*, a continuous flow of electrically charged particles from the sun. When there are many sunspots on the sun, increased particles are released and, thus, there is a brighter aurora. The aurora is usually visible only from latitudes near the geomagnetic poles but may be seen nearer the equator during times of peak sunspot activity. The aurora occurs in the upper atmosphere, usually 60-620 miles (97-1,000 km) above Earth.

Classroom Activity

- Use the transparency Earth's Magnetic Tail to review information learned in the previous lesson. Show the students pictures of aurora of Jupiter and Saturn from *Guide to Space*.
- Visit the Web site below as an introduction to the students. Explain that when people first saw these beautiful displays in the sky, they were afraid. Not knowing what caused them, they made up stories to explain these phenomena. Tour the spectacular photos and read the information on pages 1-4. If possible, use a large monitor to show the details.

The Aurora

<http://gedds.pfrr.alaska.edu/aurora/english/introl.htm>

- Tell students that they will visit a variety of Web sites to learn more. One site comes from the University of Alaska, near the North Geomagnetic Pole. Show where Fairbanks is located relative to the North Geomagnetic Pole.
- Divide students into groups and give each a research card. Assign more students to the starred cards since they require a longer time to complete. Review the assignments and set a time to complete the research and prepare a presentation for the class.
- Before presenting their information in the order of the cards, have each group meet with those presenting before and after them to coordinate and avoid repeating information provided by another group.

Assessment

Have students write their own illustrated legend to explain the aurora and then add a summary of the scientific explanation they have learned.

Extender

- Show the students the nine pages of aurora pictures at the following Web site.

Aurora Images

<http://www.geo.mtu.edu/weather/aurora/images/aurora/jan.curtis/>

- Let students see the paintings of Canadian artist Glen Scrimshaw which were inspired by photographs of aurora. Have the students create their own aurora pictures.

Northern Lights Newest Images

<http://climate.gi.alaska.edu/Curtis/aurora/aurora.html#NEWESTIMAGES>

Aurora Research Cards

Aurora Legends

To the Team: You are a team of astronomers who have been asked to be part of a group of scientists who will explain the aurora to a class of students. The information your team is to report is located at a Web site in Fairbanks, Alaska.

- Go to the Web site: <http://gedds.pfrr.alaska.edu/aurora/english/Legend1.htm>
- Read the information on pages 5-8 and take notes. If possible, make prints of the pictures to use these in your presentation. Set the printer to the horizontal position to keep the pictures from overlapping.
- Prepare your report, including interesting information, pictures from the Web site, or your own drawings to make your presentation exciting.

The Aurora and Polar Explorers

To the Team: You are a team of astronomers who have been asked to be part of a group of scientists who will explain the aurora to a class of students. The information your team is to report is located at a Web site in Fairbanks, Alaska.

- Go to the Web site: <http://gedds.pfrr.alaska.edu/aurora/english/Explor1.htm>
- Read the information on pages 9-13 and take notes. If possible, make prints of the pictures to use in your presentation. Set the printer to the horizontal position to keep the pictures from overlapping.
- Prepare your report, including interesting information, pictures from the Web site, or your own drawings to make your presentation exciting.

☆ How High in the Sky Are the Aurora? Where on Earth Can You See the Aurora?

To the Team: You are a team of astronomers who have been asked to be part of a group of scientists who will explain the aurora to a class of students. The information your team is to report is located at a Web site in Fairbanks, Alaska.

- Gather your information from two Web sites listed below.
How High: <http://gedds.pfrr.alaska.edu/aurora/english/Height1.htm> (pages 14 and 15)
Where on Earth: <http://gedds.pfrr.alaska.edu/aurora/english/Where1.htm> (pages 16-21)
- Read the information and take notes. If possible, make prints of the pictures to use in your presentation. Set the printer to the horizontal position to keep the pictures from overlapping.
- Prepare your report, including interesting information, pictures from the Web site, or your own drawings to make your presentation exciting.

Aurora Research Cards *(cont.)*

☆ Space Weather and Predicting Answers

To the Team: You are a team of astronomers who have been asked to be part of a group of scientists who will explain the aurora to a class of students. The information will come from two Web sites shown below.

- Go to the Web site: <http://rigel.rice.edu/~freeman/dmb/spwea.html> Read the information and write a brief summary. If possible, print the pictures.
- Go to: http://www.exploratorium.edu/learning_studio/auroras/difcolors.html Current information and predictions of aurora sightings are given here.

Click on Custom Maps and then click on your location. A map of the North American continent will appear, showing the range predicted for viewing the aurora.

- Prepare your report, including interesting information, pictures from the Web site, or your own drawings to make your presentation exciting.

☆ Aurora Light

To the Team: You are a team of astronomers who have been asked to be part of a group of scientists who will explain the aurora to a class of students. The information your team is to report is located at the following Web sites.

- **What Kind of Light Does the Aurora Emit?**
<http://gedds.pfrr.alaska.edu/aurora/english/Light1.htm> (pages 22-24)
- **What Makes Aurora Happen?**
http://www.exploratorium.edu/learning_studio/auroras/happen.html
- **How Is the Aurora Discharge Powered?**
<http://gedds.pfrr.alaska.edu/aurora/english/Power1.htm> (pages 25-29)
- **Why Are They Different Colors?**
http://www.exploratorium.edu/learning_studio/auroras/difcolors.html
- Prepare your report, including interesting information, pictures from the Web site, or your own drawings to make your presentation exciting.

☆ Aurora Motion and the Sun?

To the Team: You are a team of astronomers who have been asked to be part of a group of scientists who will explain the aurora to a class of students. The information your team is to report is located at the following Web sites.

- **Why Does the Aurora Move?**
<http://gedds.pfrr.alaska.edu/aurora/english/Motion1.htm> (pages 30-32)
- **How Does the Sun Affect the Aurora?**
<http://gedds/pfrr.alaska.edu/aurora/english/Sun1.htm> (pages 33-39)
- Prepare your report, including interesting information, pictures from the Web site, or your own drawings to make your presentation exciting.